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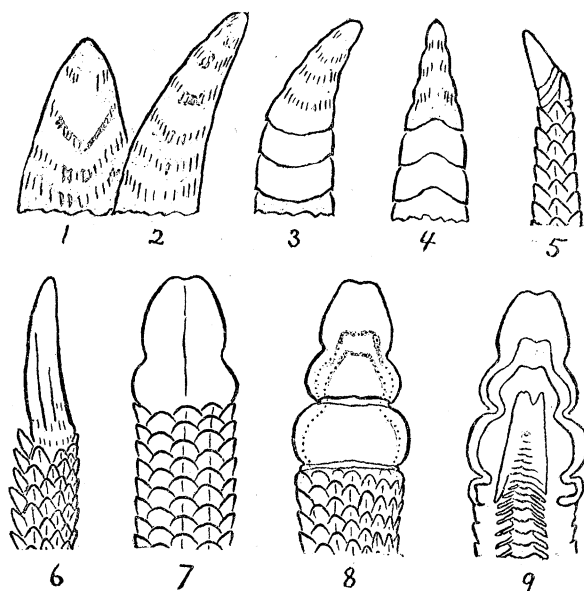
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the slough. On a few there are constrictions and ridges around the cap, that recall those on the spines of the lizard. As it happens, those marked in this manner are the nearest living allies of the rattlesnakes. In the paper on the Evolution of the Rattle, above cited, the copperhead, *Ancistrodon* (Fig. 5), was brought forward as most nearly representing the ancestor of the smaller rattlesnakes, *Sistrurus*; and the bushmaster, *Lachesis* (Fig. 6), of northern South America, was suggested as the most likely for the large rattlers, *Crotalus*. These forms were pointed out as so nearly approximating a condition from which the possession of a rattle was a necessary consequence that we might at any time expect to find individuals on which the caps were mechanically retained. My conclusions in regard to the inception of the rattle seem to be indirectly confirmed by what obtains on the lizards. This will be the more apparent if it is borne in mind that the present development of the rattle (Figs. 7-9) embraces much that is a consequence of its



Figs. 1-2, nuchal spines, and 3-4, a dorsal spine of *Conolophus suberistatus*; Fig. 5, tail of *Ancistrodon contortrix*; Fig. 6, tail of *Lachesis mutus*; Fig. 7, *Sistrurus catenatus*, at birth; Figs. 8-9, *Crotalus confluentus*.

possession, much that has been induced by its presence and use. The greater part of the shortening-forward in the extremity of the tail, of the compacting and consolidation of the posterior vertebræ, with the enlargement of the cap to include them, and much of the development of the caudal muscles must be eliminated before one can realize the primary condition of the rattle, a condition which was, no doubt, but a little advanced upon that now existing in *Ancistrodon* and *Lachesis*, as sketched in Figs. 5 and 6.

Mus. Comp. Zool., Cambridge, Mass.

OPPOSITION OF MARS.

BY EDGAR L. LARKIN.

THE coming opposition of Mars will be of interest to astronomers throughout the world; and extensive preparations are being made to observe it. The face of the god of war is sure to be watched, drawn, and photographed with more care than ever before. And the most perfect spectroscopes made will be turned on his ruddy disk. The sun, earth,

and Mars will be on the same straight line nearly, on Aug. 3 at 13 h. 13 m., or at 1 h. 13 m. A.M., Aug. 4, 1892. The time of the opposition will be favorable for observation, since the earth passes its aphelion on July 1, while Mars does not pass his perihelion until Sept. 7. That is, the earth will be 34 days only past the time when at its greatest distance from the sun; and Mars but 35 days from its nearest approach. If these dates could coincide — opposition take place when the earth is at a maximum and Mars at a minimum distance from the sun — then would the earth and Mars be at a minimum distance from each other, or 33,864,000 miles; in which computation a solar parallax of 8.8" and a mean distance of Mars of 141,500,000 miles were employed. However, since the opposition will occur midway between, it is probable that, at the moment of the nearest approach of the two planets, they will be distant about 35,500,000 miles.

The last opposition favorable for close observation was on Sept. 5, 1877; at which approach, Professor Asaph Hall discovered two minute moons in revolution around our neighboring world. This important discovery is best given in Professor Hall's own language: "The sweep around the planet was repeated several times on the night of Aug. 11, and at half-past two o'clock I found a faint object on the following side and a little north of the planet, which afterwards proved to be the outer satellite. On Aug. 16 the object was found again on the following side of the planet. On Aug. 17, while watching for the outer satellite, I discovered the inner one." Perhaps this optical discovery reveals the power of modern telescopes in a manner more impressive than any other, thus: "The outer one was seen with the telescope at a distance from the earth of 7,000,000 times its diameter. The proportion would be that of a ball two inches in diameter viewed at a distance equal to that between the cities of Boston and New York" (Newcomb and Holden, "Astronomy," p. 338).

These moons were seen with the 26-inch glass at Washington; but now a 36-inch telescope is in waiting for Mars, and none can predict what will be discovered. The satellites are estimated to be 6 and 7 miles in diameter; and they have a most rapid motion. It is well to note some of the facts about these bodies that served a great purpose, in sweeping away that mythology of astronomy, the nebular hypothesis. Distances from centre of Mars: Deimos, 14,600 miles; Phobos, 5,800 miles. Times of revolution: Deimos, 30 h. 18 m.; Phobos, 7 h. 39 m. But it requires 24 h. 37 m. for Mars to turn on its axis, which divided by 7 h. 39 m. equals 3.22; that is, the inhabitants of Mars have 3.22 months of Phobos every day. This moon rises in the west and passes through a phase in 1 h. 55 m. Deimos is 130 h. 37 m. from rising to rising, or 65 h. 18 m. from rising to setting. Its gain over the rotation of Mars is 3° 24' per hour, hence it requires 106 hours to gain a whole revolution, which, added to the diurnal rotation of the planet, gives the 130 h. 37 m. But 65 h. 18 m. equals 2.155 months of Deimos; therefore the other satellite passes more than two full sets of phases while above the martial horizon, with plenty of eclipses beside.

The main interest in the next opposition rests in the hope that an accurate map of Mars can be made, or that good photographs can be secured, or that the spectroscope may make further revelations concerning the absorption of solar rays by its atmosphere, or that the lines due to the vapor of water may be seen to better advantage, if possible, than at the last. Professor C. A. Young, "Astronomy," p. 337, says: "The probability is that its density is considerably less than that of our own atmosphere. Dr. Huggins has found with

the spectroscope unequivocal evidence of the presence of aqueous vapor."

The idea that water exists on Mars is supported by the fact that white patches are seen on the poles, and that these vary in size with variations of inclination of the axis toward the sun. The white area is now well seen at this observatory on one of the poles. So rapid has been the advance in celestial photography, and in spectroscopy, and also in the size of telescopic objectives during the last 15 years, that without doubt much additional knowledge of Mars will be gained in August.

Knox College Observatory, Galesburg, Ill., July 1.

CROSS-FERTILIZING AND HYBRIDIZING.

THE following excellent suggestions are from the eminent horticulturist, Professor T. J. Burrill, of the Illinois experiment station. The subject is one calling for the co-operation of farmers and fruit growers everywhere with the experiment stations, for where nature has laid the foundation for improvement by giving us such a wild seedling as the Concord grape, that should be made the basis for further work.

Cross-fertilizing and hybridizing have been carried on to some extent, both for the effects of crossing and for the purpose of producing, if possible, new varieties of value. A number of crosses have been made in the apple, as for instance, between Ben Davis and Grimes, Ben Davis and Minkler, or Ben Davis and Duchess, with a view of getting something that will bear like the Ben Davis, but have the better quality of Grimes or Minkler, having the keeping quality of Ben Davis and the hardiness of tree of the Duchess. Different varieties of strawberries have been crossed, and plants are growing from the crossed seed. Blackberry varieties have been crossed, seeds planted, and plants are growing. Raspberries have been crossed—black varieties together, red varieties together, black with red, and blackberries with raspberries. We have now ready for planting more than a quart of seed from crossed raspberry and blackberry, or from selected varieties.

Results are problematical, but there is certainly great room for improvement in our blackberries and raspberries. There is entirely too much seed for the amount of flesh. When we consider that our apples originated from a crab in no way superior to many of our own native wild crabs, and the excellence that has been developed by cultivation and selection, what may we not expect from our raspberries and blackberries, which are so much better naturally? We have only begun with the raspberry and blackberry group of plants. I believe none of the blackberries or dewberries now cultivated are the result of growing plants from seed, but that all are the result of propagating natural seedlings, and it is not at all certain that we have yet the best of the wild varieties. Most of our raspberries are the result of chance.

During the past three seasons some work has been done in the line of crossing and selecting corn. The results seem to indicate that corn grown from crossing two distinct varieties will be larger than the average of the kinds crossed, or where the parents are nearly equal in value. To be sure, nothing has yet been reported in that line, though there would seem to have been abundant time for seedlings to have been grown. If the results of our crosses in corn are to serve as an index, we might expect to find in a second or third generation fruit of the *Vinifera* type on vines of the

Labrusca. There is a great difference in the susceptibility of fruits to the influence of man. Our grapes have had more time spent on them, extending over a longer period, than have our strawberries; yet the results from grapes are hardly to be compared with the results from strawberries.

A small start has been made in the growth of nuts. The attempts at improvement heretofore have been confined almost exclusively to the pecan and chestnut. Attempts at improvement by growing seedlings from the best native trees have usually been a disappointment, because the seedlings have been inferior to the tree from which seed was taken, just as 999 of every 1,000 seedlings grown from the Concord grape have been so inferior to the parent as to be unworthy of general distribution. But it must be remembered that while there are comparatively few chances for improvement by growing seedlings there are none from simply budding or grafting.

The filbert and walnut of Europe are too tender for our climate. Why may not our hazel-nut and walnut be improved so as to take their places, and be made valuable crops for the rough lands along our streams?

NOTES AND NEWS.

AN interesting feature has been added to the first United States Food Exhibition, to be held at Madison Square Garden, New York, in October next, in the way of a national exhibit of dairy products. This department will be in charge of Professor James Cheesman, who represented the dairy interests of the United States at the late Paris Exposition. Professor Cheesman has a wide reputation as a dairy expert and as an authority on all matters pertaining to the dairy interests. This part of the exposition promises to be one of its most popular features.

—The *Journal de Colmar* of June 19 says: The president of the committee entrusted with the erection of a monument to Hirn has received a letter from the maire of Strasburg, in which he makes the following statement: "I have the pleasure of announcing that, upon the receipt of your letter of the 23d, relative to the participation of the city of Strasburg in the erection of a monument to M. G. A. Hirn, the municipal council has determined to contribute to this work the sum of 800 marks. I have ordered this amount to be credited to you, and it may be obtained from the municipal collector, who will transfer it to the treasurer of the committee, M. Baer. I trust that the example of Strasburg will find many imitators."

—Cornell University closed the college year 1891-2 on June 16, conferring above 300 degrees, of which about one-half were in scientific and technical courses, and a large number of which were the higher degrees. The graduating class was the largest in the history of the University, and is said to have been the strongest. The year terminates the connection of a number of the members of the faculty with the university, and this fact and the anticipated growth for the coming year will render it necessary to appoint a still larger number of new professors and instructors. The indications, judging from the numbers entering at the June examinations, are said to point to an entering class in September of not far from 500, and of probably fifteen or twenty per cent more in the upper classes and as graduate students, making a probable total of about 1,600 in all departments and classes. Sibley College, with its special and graduate schools and departments in mechanical engineering, will prepare for a total of 625 students, a hundred more than in 1891-2. In addition to new appointments already made, it is expected that professorships will be filled in geology, chemistry, and possibly one or two other subjects; also a number of assistant professorships and many instructorships in all departments, including physics, engineering, and mechanic arts. The appointments in scientific departments are usually such as demand familiarity with laboratory instruction, especially in electricity and mechanics.